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ABSTRACT

This report details a plan to effectively integrate technology into the classroom. The targeted population consisted of one first grade class and one multi-age first and second grade class housed in a K-2 building. The school is located in a middle class suburban city in the Midwest. Although technology was readily available in the school, its non-effective use was documented by teacher surveys, student self-assessments, technology sign-out sheets and a classroom computer use checklist. Analysis of the probable cause indicated that classroom computers were not used regularly, nor were teachers comfortable integrating technology into the curriculum. Due to the lack of ongoing teacher training, teachers felt ill prepared to integrate technology into the curriculum. This situation had an adverse effect on students who therefore were not receiving opportunities to use the available technology to its fullest potential. A review of the literature combined with a year long technology integration class suggested that ongoing teacher training is essential to changing philosophies and increasing the comfort level of teachers. Regular in-classroom access to technology is critical to increasing its effectiveness with students. Post intervention data indicated that the students' ability to use technology as an effective tool for learning was greatly increased. Although targeted students scored higher on the self assessment rubric than non-targeted students, more research is necessary to determine whether the improved technology skills are a result of the intervention. Appendices include the teacher survey, student self evaluation survey, engaged learning framework for Native American unit, and student work samples. Contains 28 references. (Author/MES)

A STUDY ON THE EFFECTIVE USE AND INTEGRATION OF TECHNOLOGY INTO THE PRIMARY CURRICULUM

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DEDICATION

We dedicate this project to all the men in our lives; Rich, Dan, Doomis, Seymour, Spencer, Elmo and Chewy. Whether human or animal, they were always around to provide support and encouragement.

ABSTRACT

This report details a plan to effectively integrate technology into the classroom. The targeted population consisted of one first grade class and one multi-age first and second grade class housed in a K-2 building. The school is located in a middle class suburban city in the Midwest. Although technology was readily available in the school, it's non-effective use was documented by teacher surveys, student self-assessments, technology sign-out sheets and a classroom computer use checklist.

Analysis of the probable cause indicated that classroom computers were not used regularly, nor were teachers comfortable integrating technology into the curriculum. Due to the lack of ongoing teacher training, teachers felt ill prepared to integrate technology into the curriculum. This situation had an adverse effect on students who therefore were not receiving opportunities to use the available technology to its fullest potential.

A review of the literature combined with a year long technology integration class has suggested that ongoing teacher training is essential to changing philosophies and increasing the comfort level of teachers. Regular in classroom access to technology is critical to increasing its effectiveness with students.

Post intervention data indicated that the students' ability to use technology as an effective tool for learning was greatly increased. Although targeted students scored higher on the self assessment rubric than non targeted students, more research is necessary to determine whether the improved technology skills are a result of the intervention.

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CHAPTER 1

PROBLEM STATEMENT AND CONTEXT

General Statement of the Problem

The students in the targeted kindergarten through second grade building are not using technology as an effective tool for learning. Evidence for the existence of the problem includes, a lack of technology use by students and teachers as documented through the monitoring of computer use and sign out sheets, teacher surveys reflecting their comfort level using and teaching technology, and student assessments of skills and ability to problem solve.

Immediate Problem Context

The site used in the following research is a kindergarten through second grade building. This building is part of a small elementary school district. Classroom A is a first grade room. Classroom B is a first and second grade multi-age class. The students in class B stay with the teacher for two full years. The school day begins at 8:25 am and ends at 2:25 pm. The following information is taken from the 1998 School Report Card.

This district serves 1,716 students, 349 of which are housed in the school. The students in this district are predominately white. Table 1 shows the racial background and total enrollment of this school.

Table 1

Racial/Ethnic Background and Total Enrollment

	White	Black	Hispanic	Asian	Native American	Total Enrollment
School	78.8%	2.0%	8.6%	10.6%	0.0%	349
District	84.3%	1.6%	5.7%	8.2%	0.2%	1716

There are few students from a limited English proficient setting and fewer from low-income families. The school's enrollment of low-income and limited English proficiency

students is slightly higher than the district's percentages. Table 2 indicates these percentages.

Table 2

Low-Income and limited English proficient

	Low-Income	Limited English Proficient
School	6.6%	10.9%
District	5.5%	5.9%

This district has a high attendance rate, with little student mobility. The school also has a high attendance rate, however the student mobility rate is slightly higher than the district . The district and school have no chronic truancy. Table 3 reflects these percentages.

Table 3

Attendance, Mobility and Chronic Truancy

	Attendance	Student Mobility	Chronic Truancy
School	95.3%	10.6%	0.0%
District	96.0%	6.2%	0.0%

The 1998 School Report Card also states that this site spends $6,748 per pupil. This is $467 more than the state average. Fifty-eight percent of the district's expenditure is spent from the education fund, compared to 73% which is the state average. Large proportions (23.6%) of the monies are spent on operations and maintenance.

There are 15 single teacher classrooms in the school: 1 early childhood , 3 kindergarten, 4 first grade, 3 second grade, and 4 first and second grade multi-age rooms. All specialist and resource teachers have their own rooms. Classrooms are heterogeneously grouped. Most of the first graders loop to second grade with their teacher and classmates. All multi-age students stay with their teacher for two years. The classrooms have one teacher with the exception of early childhood, which also has one speech and language pathologist and a full time teacher aide. There are three classrooms

which contain students whose Individualized Education Plan (IEP) requires them to have a full time aide.

First and second grade students receive 90 minutes of gym, 40 minutes of art, 40 minutes of library instruction and 50 minutes of music per week. Students with social, academic, or behavioral concerns are served by a full-time social worker, and full-time teachers specializing in Title 1, Learning Disabled/Behavior Disordered resource services, speech and language, and ESL (English as a Second Language).

All schools within the district are linked by a local area network (LAN) server. The school library houses Macintosh computer lab containing 25 desktop computers. There are various models and not all are compatible with the software used by the district. All of the computers have printer connections. Nine of the 25 computers have internet connections.

Each classroom has one Power Macintosh computer connected to the internet and district server, and one color printer. In addition, some classrooms have other computers, which are older models and are not internet or server compatible. For the 1999-2000 school year the district offered a Technology Integration Program (TIP). Teachers who volunteered to participate received an additional 3 to 4 iMac computers with internet capability in their classrooms. The school owns 8 digital cameras, 1 scanner, 2 multi-media presentation centers, 2 lap top computers, 2 video cameras, and 5 VCRs on carts. The district technology plan calls for each classroom to be equipped with one 27" video / computer monitor and a video cassette player for the 1999-2000 school year. Finally, the district has hired a full time technology facilitator whose responsibilities include training teachers to integrate technology into the curricula.

The school encourages community involvement. Parents and senior citizens volunteer regularly and work with students. Each school in the district has a School Improvement Committee made up of parents, teachers and administrators who work to improve the quality of the schools. Community members also serve on the district technology committee. A future goal of the technology committee is to open the district computer labs for the community to use.

The Surrounding Community

The school is part of a small Midwest suburban school district, 20 miles outside of a

major metropolitan center. According to the 1990 census, the population of the school community is 15,239 . Average per household income for the school community is $43,101 as of the 1990 census. The average resident is 32 years old. Housing ranges in price from $60,000 for the less expensive condominiums to $450,000 for the higher price single-family homes (Wexcel, 1995). Crime is extremely low in this school's community with a crime rate of 2.552% (Wexcel, 1995). The district serves four local communities, which are comprised of light industry, single-family homes, townhomes and apartments. Various racial and ethnic backgrounds make up this community of professionals and blue-collar workers.

The district is made up of one middle school, one K-5 building, one K-2 building and one 3-5 building. According to the 1998 School Report Card, the teaching staff employed by this district consists of 87.3% female, and 12.7% male teachers, all of white ethnic background. The average teaching experience in the district is 12.9 years. Table 4 shows that there is evidence of teachers' commitment to advance themselves educationally.

Table 4

Teacher/Administrator Characteristics

	Average Years Teaching	Teachers with BA	Teachers with MA and above
District	12.9 years	50.6%	49.4%

The School Board consists of seven elected members who serve for four years. The district's administrative staff is made up of eight individuals: a superintendent, an assistant superintendent, a business administrator, four principals, and one assistant principal. During the 1998-1999 school year, the administrative staff increased by one. A full time technology coordinator was hired. The technology coordinator's responsibilities include the maintenance of all equipment, the writing of a state mandated district technology plan, applying for technology grants and heading the district's technology team. The creation of this position reflects the administrative and School Board's growing awareness for the need of technology assistance.

National Context of the Problem

The past decade has seen a great increase in the number of computers found in early childhood and primary classroom settings. In 1984, the computer to student ratio was 1:125. By 1997 this ratio had improved to 1 computer for every 10 children (Clements, 1998). The term *technology* is not limited to computers. Technology encompasses all equipment such as printers, scanners, monitors, digital cameras, VCRs, tape recorders, CD players, etc. Although the amount of technological equipment in schools has greatly increased, students are not using technology as an effective tool for learning.

More technology in the classroom is still needed. In a recent NEA (National Education Association) Communication Survey it was found that more than two-thirds of elementary teachers had access to a single computer in their classroom (McKenzie, 1998b). One computer per classroom is not enough technology "for most students to have their schooling experiences significantly and frequently affected" (Becker, 1994) . President Clinton has recognized this need and is "calling for modern equipment in all classrooms and relevant training and support for teachers (Coley, Cradler, & Engel, in Latham, 1999).

Standards for student achievement in technology also need to be established. The International Society For Technology in Education (ISTE) has initiated the National Education Technology Standards (NETS) project. The main goal of NETS is to develop national technology standards for students in grades Pre K-12. Over the next three years these standards will continue to be developed and refined. It is hoped that these goals will facilitate school improvement throughout the United States. (National Education Technology Standards Project, 1999).

The targeted school has an average of two computers per classroom. Although this is slightly higher than the national average, it is still not enough computers for technology to be used effectively. Along with the lack of technology available, there are other obstacles that teachers face when integrating technology into the curriculum.

CHAPTER 2

PROBLEM DOCUMENTATION

Problem Evidence

Although technology is readily available at the targeted school, it is not being used effectively. This has been documented through teacher surveys evaluating how teachers are using the available technologies, student self assessment rubrics, and technology usage checklists. Data was collected from 41 children ranging in ages from six to eight years old. The teacher survey was given to 14 classroom teachers and was completed and returned by 13 teachers.

Teacher Survey

The teachers were surveyed on how they use technology with their students. This survey can be found in Appendix A. The results of the survey confirmed that technology is not being effectively integrated into most classrooms on a daily or weekly basis. Effective technology use is demonstrated when students are using the technology to solve problems, find information, or publish writing that relates to their curricular studies (McKenzie, 1998a & 1998b). Results showing that technology is not being used on a weekly or daily basis are listed in Table 5.

Table 5 indicates that technology is most frequently used for free time. Free time is given when students have completed the required work and are allowed to choose an activity. Most frequently this activity is a "game-like" computer program which may or may not relate to the curriculum. Teachers do not monitor or direct the activity. Therefore, free time is not considered to be an effective use of technology.

Table 5 also shows that 30% or approximately one third of teachers do not integrate technology into their curricular units more than once a month. Furthermore, 75% of the teachers used technology for journal writing once a month or less. Only 9% of students are given opportunities to use word processing for publishing their writing on a weekly basis. The areas of word processing and publishing are important life skills and most students are

not receiving practice. These survey results are evidence that technology is not being used effectively at the given school.

Table 5

Frequency of Technology Use

	Never	Once a trimester	Monthly	Weekly	Daily
Frequency of Curricular Technology Integration	0%	15%	15%	46%	24%
Frequency of Free Time Use	0%	0%	0%	46%	54%
Frequency of Student Word Processing for Journal writing	15%	32%	30%	23%	0%
Frequency of Student Word Processing for Publishing	32%	13%	46%	9%	0%

Students come to the classroom with a variety of technological skills. Some children have been exposed to technology and feel comfortable using it. On the other hand, there are children who have little or no experience using technology. Students in the targeted classrooms were asked to self-evaluate their ability levels using technology. Surveys were given on an individual basis, with a trained volunteer clearly explaining each item. The results are listed in Table 6. The student self evaluation survey can be found in Appendix B.

This survey was given to two classrooms of children. One class contained 21 first graders. The second class contained 11 first graders and 9 second graders. This survey was conducted in the first trimester of the school year. Most of the first grade students would not have had exposure to the surveyed skills. The second grade students were exposed to the surveyed skills during the previous year. During the current school year, the children in the two classrooms surveyed had been exposed to turning the computer on and off as well as the application programs, Kid Pix and ClarisWorks. These skills were all directly taught by the classroom teacher and as a result, have the highest number of proficient children.

Table 6

Student Self Assessment

Skill	% Proficient	% Familiar	% Incapable
I can draw a picture using Kid Pix.	61%	32%	7%
I can e-mail a friend or teacher.	21%	21%	58%
I can type a journal page, save it and print it using Claris.	42%	32%	26%
I can turn the computer on and shut it down.	79%	5%	16%
I can find things that I have saved on a disk or the server.	29%	26%	45%
I can find research on the internet.	21%	21%	58%
I can use WiggleWorks.	24%	8%	68%
I can download pictures from the internet.	3%	34%	63%
I can use the digital camera and put pictures in the news.	10%	37%	53%

When comparing student rubric results with teacher anecdotal records, a discrepancy was found. It appears that students indicated a familiarity using the technology skills when in reality they had knowledge that the technology existed, but could not demonstrate its use. After completion of the survey, the teachers of the targeted classrooms reviewed the student surveys and found 85% of them to be accurate with their own anecdotal records.

Table 6 indicates that there are only two skills areas in which a majority of the students feel proficient. In support that technology is not being used effectively, the survey revealed that there are five areas where the majority of the students ranked themselves as incapable of using the technology. The user checklist further revealed that technology is simply not being used by the students in the targeted school.

Usage Checklist

To establish if technology is being used in the 14 regular education classrooms and computer lab, random usage checks were initiated. Beginning the fifth week of school, random checks for usage of every classroom computer were taken. Using the Apple Network Administrative Toolkit, the Building Technology Facilitator was able to monitor which computers were turned on and what applications, if any, were running. When programs were running, the technology facilitator could view the monitor and see what work was being done. For example, a check could determine that ClarisWorks was running and a permission slip was being composed. The nature of this document indicates that an adult was creating it. Because the targeted school is a K-2 building, the typing speed, grammar and spelling indicate whether a child or an adult is using the computer. Checks were done on a random schedule over a five week period. In total, 15 checks were made. The results are listed in Table 7.

Table 7

Classroom Technology Usage

% Turned Off	% Used by Students	%Used by Teachers	% On but Not Used
31%	14%	12%	43%

Table 7 shows that on average 31% of the computers in classrooms were turned off during the school day. The average was calculated by recording the number of computers turned off at any given check and dividing it by the total number of computers in the classrooms. The average percent of use was found the same way. Of those that were turned on, 43% were not in use. One hundred percent use of computers is not expected, nor possible in a school day. The goal is not to replace current curriculum with technology, but rather to enhance it. However, when only 14% of students are using technology at any given time, it would imply that most students are not receiving daily exposure to technology.

Usage was also monitored in the computer lab. Teachers are encouraged to sign up for a 40 minute weekly time slot in the lab. Once signed-up, it is not mandatory to attend.

The classroom teacher is responsible for all technology lessons conducted in the lab. There is no technology teacher or support personnel present.

During the eighth week of school the Building Technology Facilitator conducted hourly checks to determine if the computers in the lab were being used. This information was compared with the lab schedule to see if teachers were using the lab during their reserved time slots. During the week monitored, the lab was used only once by a classroom teacher, and once by a special services teacher. Ten teachers had signed up to use it. It is evident that the computer lab is not being used effectively.

It has been established that technology is not being used effectively. Teacher surveys at this site revealed that teachers are not using technology to support their curriculum nor for increasing student word processing and publishing skills. Rather, the most frequent use of technology is for free time. Students surveys reflected that the majority of children are not proficient in most skill areas. It has also been found that the technology available is not always used. To effectively assist teachers in improving their technology skills and the teaching of technology to students, there must be an attempt to understand the underlying causes for the lack of effective technology usage.

Probable Causes

There are many factors that affect the lack of technology use with primary students. First, teachers are simply not comfortable using or teaching the technologies. Teachers are not receiving the exposure to technology that is vital both during pre-service and in-service training. When technology is used, it is not always used as an effective tool for learning. Finally, many districts have not created technology benchmarks. Where there is no expectation to teach technology, it is not taught.

Teacher Comfort

The teachers at the targeted site were requested to rate their comfort level in both using and teaching various forms of technology available at the school. All teachers surveyed have had the opportunity, whether through mandatory staff development or voluntary workshops, to learn about the surveyed technologies. The survey asked teachers to rate their comfort level from 1 through 5, 1 representing very uncomfortable and 5 representing very comfortable. When interpreting the survey, the ratings of 1 through 3

indicate discomfort. Discomfort is defined as being unsure of how to use the technology independently and to its full potential.

The survey revealed that teachers are uncomfortable both using and teaching the technologies available to them through the school and in the classroom. Table 8 displays the percentage of teachers who are personally uncomfortable using the specified technologies. The table also displays the number of years the given technology has been available in the classroom. Teachers are generally more comfortable with technologies that have been around 6 or more years. However, there are a few exceptions.

A district initiative to minimize paper waste has made the use of e-mail mandatory, therefore a high percentage of teachers have become comfortable with this technology in a short amount of time. The survey found that 46% of teachers stated that they felt comfortable saving to a server. The technology facilitator was asked to report the number of teachers who had logged onto the server within a one month period. Of the 14 classroom teachers, only three had done so. The validity of this self-report is therefore questionable.

Table 8

Teacher Comfort Levels Using Technology

Technology	Years Available	%Comfortable	% Uncomfortable
Using CD ROMS	6	85%	15%
Saving to a disk	6	85%	15%
Using ClarisWorks	6	85%	15%
Using Kid Pix	6	54%	46%
Using WiggleWorks	4	54%	46%
Using digital cameras	4	38%	62%
Using scanners	4	15%	85%
Using the internet	2	46%	54%
Using e-mail	2	62%	38%
Saving to a server	2	46%	54%
Creating web pages	2	15%	85%

Table 9 shows how teachers feel about teaching their students the aforementioned technologies. However, some teachers feel that it is not developmentally appropriate for their students to use the specified technologies therefore, the option of Not Applicable was given in addition to the rating scale from 1 to 5. Table 9 shows that teachers exhibit a much higher level of discomfort when teaching the same technologies to their students. The percent who felt the technology was not developmentally appropriate to their grade level is also indicated.

Table 9

Teacher Comfort Levels In Teaching Technology

Technology	Years Available	% Comfortable	% Uncomfortable	% Not Applicable
Using CD ROMs	6	77%	23%	0%
Saving to a disk	6	67%	25%	8%
Using ClarisWorks	6	77%	23%	0%
Using Kid Pix	6	54%	46%	0%
Using WiggleWorks	4	50%	42%	8%
Using digital cameras	4	12%	73%	15%
Using scanners	4	0%	77%	23%
Using the internet	2	30%	55%	15%
Using e-mail	2	13%	56%	31%
Saving to a server	2	23%	69%	8%
Creating web pages	2	3%	82%	15%

When teachers are personally uncomfortable using and teaching with technology, students are not learning technology skills. In comparing Student Self Assessment and Teacher Comfort Levels in Teaching Technology (Tables 6 and 9) it is found that students excel in the areas that teachers are most comfortable teaching. For example, 77% of teachers felt confident in their abilities to use ClarisWorks and 42% of students were also comfortable in using the same program. Conversely, 38% of teachers felt comfortable using digital cameras and 10% of students surveyed felt comfortable using the same

technology. In order for student achievement in the area of technology to be further increased, teachers must be comfortable with using the technology. The likelihood of teachers introducing a skill that they do not feel proficient in, is slim. It is not enough for teachers to know how to use the technology, it must be used regularly. In order for teachers to become comfortable in using technology, continual training must be provided.

Lack of Pre-Service Training

Many of the teachers surveyed felt that more training and staff development is necessary. Research has found that universities do not incorporate technology into their methods courses for pre-service teachers (Persichitte, Tharp & Caffarella, 1997; Education Technology News, March 1998). Richard W. Riley, Education Secretary, stated to eSchool News (1999) "Teacher education and professional development programs are not addressing the realities found in today's classrooms ." Many teacher education programs do not have the hardware or software to properly prepare aspiring teachers. They are also lacking in faculty members who are trained in using technology (Education Technology News, March 1998). In 1996, a technology survey was given to all National Council for Accreditation of Teacher Education (NCATE) member colleges responsible for teacher education programs. The survey disclosed that 31% of students have no requirements to incorporate technology into their instruction during their student teaching experience (Persichitte, Tharp & Caffarella,1997). Cooper in Education Technology News (March 1998, paragraph 10) has advised NCATE to "develop a vision of technology as an integrated part of reform....(and) develop a plan for hardware, software and technology integration across the curriculum." With this, it is hoped that new teachers will be able to use technology effectively in the classroom and that current teachers will seek training in areas of need.

Lack of In-service Training

Because technology changes so rapidly and many teachers are not abreast of technology updates, staff development and training opportunities need to be continuously provided (Roberts, 1999). A national survey done by eSchool News online reports that "less than one quarter of the teachers surveyed said they felt prepared to use computers in their classroom" (Feb. 22, 1999). At the targeted site, technological equipment preceded

training. When training was provided, it frequently was optional. The training provided emphasized how to use the equipment and not how to use it with children. Teachers were never given direction on how to integrate the new technology into the curriculum. Furthermore, teachers were not given instruction on how to problem solve when equipment did not work as expected.

There continues to be a lack of professional development opportunities in technology for teachers once they are in the classroom. Rosen and Weil (in Latham, 1999) estimate that between one and two thirds of all teachers are lacking the confidence to use technology to it's full potential. According to McKenzie , "Most professional development for technology still centers around how to use the tools, the software applications and the resources. There is little focus on strategic teaching or guidance..."(1998b, paragraph 39). To be most effective, computers must not be solely used for drill and practice, but rather strategically integrated into the curriculum (McKenzie, 1998b).

Research has found that teachers receiving less than ten hours of training will not be impacted positively (Ryan, as cited in Clements, 1998). Too often school districts quickly install the latest equipment without preparing teachers in how to use it and without considering how these technologies will be integrated into the curriculum. In order for new technologies to be effective, teacher training and curriculum development must come before the installation of hardware and software (McKenzie, 1998b). According to Barker (1994), mandatory, non threatening staff development, where teachers progress at their own pace, needs to be provided. In many situations teachers are fearful of the technology they have been given and are expected to teach. Increased training and support gives teachers a fearless attitude toward technology and allows them the confidence they need to take on new challenges (Education Technology News, March 1998). In order for comfort levels to increase, at least 30% of a district's technology budget should be spent on training its staff (Latham,1999). Teachers need to know that there is support when problems or questions arise. Studies indicate that few districts hire enough technicians to support their equipment (McKenzie, 1998a). Not only do teachers need to be trained to use technology, they must be trained to use technology effectively.

Ineffective Use of Technology

For technology to be used more effectively, teachers will have to change many of their teaching philosophies (Maurer & Davidson, 1999). According to Becker (1994), many teachers view technology / computers as an isolated subject area. Technology is rarely integrated into other subject areas. Because programs geared for the primary level are often of a game format, many teachers at the site use the computer for drill and practice games. For technology to be effective it is recommended that it be seamlessly integrated into all curricular areas.

Research has also shown that children learn best when they are actively involved and the content is meaningful to them. Too often computers are used as a tool for drill and practice work, which is neither meaningful nor engaging to students (Bowman, 1998). Maurer and Davidson (paragraph 6) suggest that many teachers' current philosophy would be stated as "I have the power, and I will give you bits of it as I see fit" (1999). With this philosophy teachers are the dispensers of knowledge. McKenzie continues: "So long as the majority of teachers value teaching above learning, we are unlikely to see dramatic changes in student performance" (1998b, paragraph 33). At the targeted school, teachers are not using technology as a tool for learning, nor do they have curricular benchmarks to guide them.

Lack of Technology Benchmarks

When referencing the targeted district's curriculum guide, no mention of technology was found. With no formal curriculum plan, teachers are unsure of what skills their students are required to posses. There is great disparity in how technology is used among the teachers at the targeted elementary school. Of the teachers surveyed, 38% felt that a formal technology curriculum would enhance their comfort level in using technology. The lack of district directives leaves teachers uncertain of what to teach.

At the given site, technology is not used to it's fullest potential. Causes may be attributed to any of the following: teacher discomfort in using and teaching technology, lack of pre-service and in-service teacher training, ineffective use or lack of use of existing technology and a lack of district technology benchmarks. These causes were evident in the literature reviewed and at the targeted school.

Teachers have the power to use technology as a tool for learning, however they must be empowered to do so. Teachers must take ownership that they are not using and teaching technology effectively. The fear of technology must be overcome and teachers must be provided with training in areas of need. Teachers, administrators, parents and students should view technology as a vital tool that enhances curriculum. Most importantly, technology needs to be used.

CHAPTER 3
THE SOLUTION STRATEGY

Literature Review

Technology has rapidly become a prevalent tool in schools. One can expect technology's presence to continue to increase exponentially. Therefore, it is necessary for schools to make many changes so that technology can be used effectively by students, teachers, and the surrounding community. These changes include a shift in teacher philosophy, the integration of technology throughout the curriculum, increased pre-service and in-service technology training and the limitless access to technology.

Teacher Philosophy

Changing teacher philosophy is a key element in making any technology implementation successful (McKenzie, 1998a). Both student and teacher roles will have to change. Teachers need to become more learner centered, focusing on a child's individual needs and learning style. Their role will also change from being the director of learning, to being the facilitator of learning. Students will no longer simply receive knowledge, rather students will be taught problem solving skills and will be encouraged to construct knowledge (Flake, 1999). Students will be encouraged to act as teachers, as well as learners.

Research in multiple intelligences by Howard Gardner and others has shown that students gain knowledge in many different ways (Lazear, 1992). Gardner's research has found seven areas of human intelligence. They are: verbal/linguistic, musical/rhythmic, logical/mathematical, visual/spatial, bodily/kinesthetic, naturalistic, intrapersonal, and interpersonal. In order to reach all students, teachers must present material addressing all the intelligences. When teachers teach with all the intelligences in mind, students possessing different learning styles are more likely to learn. Many of the intelligences can be addressed with the use of technology. For example, on-line virtual museums allow students to visually and auditorily explore places they may have only read about.

Computers, grouped side-by-side, naturally encourage children to share their findings and work together (Thouvenelle, 1999a). This appeals to interpersonal learners.

Content areas are also becoming more integrated. One lesson could include elements of math, science, literacy, and social studies. Technology should also be integrated into the curriculum. "We use technology to learn, not just to learn how to use technology" (Conyers, Kappel & Rooney, 1999, p. 83). By using technology in all areas of curriculum, it becomes a tool for learning. It's presence has purpose. It then becomes the role of the teacher to provide open ended projects that allow their students to construct knowledge (Clements, 1998; Tapscott, 1999). The teacher facilitates his/her students' learning. Davis and Shade (1999) define the role of the teacher in a computer enriched classroom to be "instructor, coach, model and critic" (paragraph 10).

Computers will never replace the teacher, rather computers will enhance a teacher's resources (Pool, 1997). CD ROM encyclopedias and the internet are excellent tools for research. Students have the opportunity to share what they have learned with their peers by creating digital slide shows or films that use pictures, sounds, and facts to bring to life the concepts learned. Graphing and spread sheet programs can help students organize and understand data.

The role of students also needs to change. Students should not be viewed solely as recipients of information. Children should be seen as experts, peer coaches and teachers (Deaton,1991). By giving children opportunities to share their learning with their peers, they are empowered as learners (Maurer & Davidson,1999; Doyle, 1999). No longer are the days when curriculum is driven by scope and sequence charts, rather curriculum is determined by children's needs and interests. Students must be given choices in their learning. By giving students choices, there is a greater opportunity for children to make a personal connection with the material and make the material meaningful. McKenzie (1998b) suggests that teachers work to create a classroom of engaged learners. He says that engaged learners are "responsible for their own learning, energized by learning, strategic, and collaborative" (McKenzie, 1998b, paragraph 7). In an engaged learning setting "teams of students employ information technologies to investigate authentic problems which parallel curriculum questions and topics" (McKenzie, 1998b, paragraph 7).

The two classrooms participating in this study began a unit on Native Americans. Rather than the teachers dispensing knowledge, the students were given the cooperative task of choosing a tribe or a geographical region where their tribe would live. Each group would be responsible for researching their tribe to find out about it's regional climate, the types of homes that were built, a craft or artwork from the tribe, and a food that was prepared. Students did research via internet, CD ROM encyclopedias, e-mailing questions to experts, watching videos, and by finding appropriate books in the school library. One classroom chose to share their discoveries with other students during a classroom pow-wow. The other classroom elected to host a Native American museum and have other students visit. Students had ownership of their learning because of the many choices they were given. In all cases, the children performed well beyond the teacher's expectations. They were excited about what they were doing. A framework for the Native American unit can be found in Appendix C.

Both teachers discovered that their students were willing and able to stay on task and work up to an hour and a half, which is well beyond the average attention span of a first or second grader. Also, several curricular areas were naturally integrated into this engaged learning project. Once teachers have begun to make changes in their teaching philosophy, they will be better prepared to begin integrating technology into the curriculum.

Curricular Integration

Computers are a powerful tool for learning. They can be used to help students solve problems on their own and allow students "to act as doers and thinkers rather than recipients of information" (Bowman, 1998, p. 9). Using the example of the Native American project, a visitor to the classroom would see children working on many different activities at once. Groups may be researching on the internet, making a model hogan out of clay, creating an informative poster or video on how to make a concho belt or reading a book about their chosen tribe. The teacher meanwhile, is facilitating each group by making sure they are on task. Questions are asked to spark students thinking and direction is given when necessary.

In order for this type of project to occur, students must have experience in using these technologies. Just as one would give direct instruction on how to solve addition problems, lessons on how to use technology must be given. In math, children must solve

many addition problems before the concept is understood. Finally, children are ready to apply their basic math skills to solve more complex problems. Similarly, students must have many opportunities to practice technology skills, so that they are prepared and comfortable to use them as a resource for problem solving. For example, a new skill such as centering a title in ClarisWorks would be modeled on a large screen monitor and children would then have the opportunity to try it. As children accumulate word processing, internet, and multimedia skills, they will be able to apply what they have learned to create published works or multimedia presentations.

Integrating technology this way does take time and effort on the part of the teacher, but usually results in increased student achievement (Clements, 1998). In order to integrate, technology must be readily available. In some instances this requires teachers to coordinate with each other, because technology must be shared. Once technology is acquired, teachers must have the time to experiment with the equipment, programs, and management of the lesson (Conyers, Kappel & Rooney, 1999). It is difficult to help a classroom of young children all at once, especially if the teacher is unsure of his or her own technological skills. Therefore, a teacher must have the time to learn how to use the technology and train parent helpers or student mentors in order to successfully integrate technology into their curriculum (Roberts, 1999).

School curriculums must also be revised to ensure that computers are being used to their full benefit. Technology is not a tool that is designed to stand alone, and therefore should not be viewed as a separate subject. Technology must be integrated throughout the curriculum (McKenzie, 1998).

> Only when computers are integrated into the curriculum as a vital element for instruction and are applied to real problems for a real purpose will children gain the most valuable computer skill, the ability to use computers as natural tools for learning (Shade & Watson, as cited in Davis & Shade, 1994).

The National Educational Technology Standards (NETS) Project has recognized the need to integrate technology throughout the curriculum and is creating basic standards (National Educational Technology Standards Project, 1999). The six standards are: Basic operations and concepts, Social, ethical, and human issues, Technology productivity tools, Technology communications tools, Technology research tools, and Technology problem-

solving and decision-making tools. In developing these standards, it was assumed that students would gain expertise through technology-based activities in the classroom. Examples of activities for the primary grades may include writing and illustrating tongue twisters using Kid Pix (a primary multimedia program), composing a daily newsletter on ClarisWorks with inserted digital photos, or keeping an electronic journal. These activities promote life skills, rather than drill and practice. They also reinforce basic technology operating skills, require social interaction and problem solving.

The NETS Project has also created Profiles for Technology Literate Students which gives performance indicators by grade level for each of the standards. Included below are the performances that all students should be able to demonstrate by the end of second grade (National Educational Technology Standards Project, 1999).

1. Use input devices (e.g., mouse, keyboard, remote control) and output devices (e.g., monitor, printer) to successfully operate computers, VCRs, audio tapes, and other technologies.
2. Use a variety of media and technology resources for directed and independent learning activities.
3. Communicate about technology using developmentally appropriate and accurate terminology.
4. Use developmentally appropriate multimedia resources (e.g., interactive books, educational software, elementary multimedia encyclopedias) to support learning.
5. Work cooperative and collaboratively with peers, family members, and others when using technology in the classroom.
6. Demonstrate positive social and ethical behaviors when using technology.
7. Practice responsible use of technology systems and software.
8. Create developmentally appropriate multimedia products with support from teachers, family members, or student partners.
9. Use technology resources (e.g., puzzles, logical thinking programs, writing tools, digital cameras, drawing tools) for problem solving, communications, and illustration of thoughts, ideas, and stories.
10. Gather information and communicate with others using

telecommunications, with support from teachers, family members, or student partners.

The major goal of these standards and profiles is to create students who are able to use technology in their daily lives and have a life long thirst for knowledge (National Educational Technology Standards Project, 1999). Teachers can use these standards as guidelines for planning technology-based activities where students are responsible for learning how to effectively communicate, and solve real life problems. These standards can also be used in creating district technology benchmarks. In order to integrate technology effectively into the curriculum, teachers must be trained.

Teacher Training

Change does not occur naturally or quickly. It has to develop over time and requires great amounts pre-service and in-service training. Many of today's teachers did not experience technology as part of their undergraduate program (Persichitte, Tharp & Caffarella, 1997). Most college faculty members do not have technology training, and most teacher education programs are severely lacking both software and hardware (Education Technology News, March 1998). Currently, certification standards for schools of education are being revised to include an increased emphasis on technology use (Education Technology News, March 1998). With a greater emphasis on technology in undergraduate teacher education programs, hopefully tomorrow's teachers will be better prepared to use and teach technology to it's full extent.

To update today's teachers, in-service training is a necessity. According to McKenzie:

> The challenge is not about training. It is about learning. If we expect teachers to turn around and use technologies daily with students they need to discover personally the power of the new technologies when combined with rich information. We also need to provide more informal support structures such as mentors, coaches and "just in time help" which often do more to promote risk taking and growth than formal class offerings. (1998b, paragraph 34)

A peer technology mentor or coach can provide ongoing support (McKenzie, 1998b). Support may include ways to integrate technology into the curriculum, how to use software,

or just basic troubleshooting. Mentors can have scheduled meetings or meet as needed. As teachers we encourage our students to share their knowledge with each other. We must remember, as teachers we also need to share our technological wisdom with each other.

Teacher support is also available via satellite. The Educational Resources company lets teachers access a number of video training modules from a desktop computer at any time (Pierce, 1999). Additionally, teachers should be given the opportunity to take computers home over the summer and weekends. With more computer contact, teachers will become familiar with the machines and their comfort levels will increase (Deaton, 1991). When teachers know how to use the technology they are more likely to integrate into the curriculum.

To further support the need for staff development, a study by Barker (1994) found that teacher attitude towards technology impacts student learning. She found that teachers who taught with a positive attitude produced students who developed a higher level of performance (Barker,1994). In order to maintain high morale, teachers' efforts and successes need to be celebrated (Thouvenelle, 1999b). A celebration could include the sharing of projects and knowledge with mentors and peers. Teachers in the primary grades recognize that small successes are an indicator of greater things to come. The teacher-researchers involved in this project feel that positively reinforcing one's own successes both encourages one to continue their own learning and lends to the enthusiasm that will be shared with students.

The Technology Integration Program (TIP) was created by the targeted district for the 1999-2000 school year. TIP is a year long staff development opportunity where participants create and implement an engaged learning project, The class was offered to all K-5 classroom teachers and was to be limited to 25 participants. A total of 20 classroom teachers agreed to participate. All participants received 3 new iMac computers, computer tables and a $500.00 stipend. The funding for this class came from a grant and the monies were matched by the Board of Education. TIP is planned to be offered again the following year, if funding is available. Current participants will then facilitate in the learning of new participants.

This is the computer age. Today's children have grown up with home computers and digital technologies (Tapscott, 1999). They are not intimidated or anxious about using

them. In order to foster this excitement, today's teachers must enthusiastically embrace what technology has to offer. They must meet this challenge by overcoming their fears. The easiest way to overcome fear is by facing the fear itself. Teachers who accept the challenge to learn how to use technology, seek out the necessary assistance, and have the courage to learn from their mistakes, will experience the greatest success (Tapscott, 1999). Children have the desire to use technology. It is the school's responsibility to make technology readily available for student's to use.

Location of Technology

The last challenge of making technology a prosperous tool for learning, is making sure that it is used. The location of technology plays a large role in it's success. By placing two chairs in front of a computer, or placing two computers next to each other, children are invited to share ideas and teach each other (Thouvenell, 1999a; Clements, 1998). It is also important that technology be used all day long, not only for centers or free time (Labbo,1996). Technology can be used in every area of the curriculum. Digital cameras can be used by students to document their daily events. Word processing programs can supplement written work. Technology should be located where learning takes place. If technology is limited, plans should be made to rotate it through the classrooms. When technology is removed from the classroom and placed in an isolated computer lab, it becomes more difficult to seamlessly integrate technology into the curriculum (Becker, 1994).

Summary

There are schools that are using technology to its full potential. They have changed teacher philosophies and provided teacher training in the area of technology. They have developed curriculums in which technology is integrated and readily available to be used by staff and students. Willow Bend, in Rolling Meadows, Illinois, is such a school.

Over a five year period, Willow Bend's administrators, staff and students worked towards the goal of achieving a technology enriched school. They had the resources, commitment and common goal to make it happen. According to principal T. Kappel (personal communication, October 21, 1999), the most important step was embracing the movement towards change. This meant all issues were dealt with up-front. Questions, concerns and fears were openly discussed. The option of transferring schools was made

available for those unable to support the changes being made. Teachers worked cooperatively to write a curriculum that would align with their new technology philosophy and meet state goals. This curriculum assures hands-on learning where children are engaged in problem solving and teachers are facilitating. Every classroom was equipped with 7-9 student computers, one computer for teacher use, a color printer, a telephone, internet access, a VCR, and a 32 inch monitor. The school also hosts a video production lab, a computer mini-lab, several laser disk players and student laptop computers. Most importantly, teachers received and continue to receive training and support.

Transitioning into a technology literate school is neither cheap nor easy. Schools who have implemented technology successfully have had teachers who are dedicated to making the change, support from the school community, and the financial resources to make it happen (Conyers, Kappel & Rooney, 1999). Technology is at the forefront of change. Roberts realizes this and advises; "you will never catch up, so stop trying" (1999, p.76). Technology is here to stay and must not be ignored. It is vital to provide our children with the tools they will need to build a successful future. Technology is the most important tool. Therefore, our schools must welcome changes to the curriculum and the way in which it is taught. They must also be willing to invest the time and money to train the teachers to use the technology properly. Finally, technology must be placed in the most accessible location for students. With these criteria met, it is possible to give students a solid foundation in the use of technology that will carry them throughout life.

In the targeted classrooms, teachers are making a conscious effort to effectively integrate technology into the curriculum. Both teachers are participating in the TIP program offered by the school district. Efforts are being made to teach with a child centered approach and integrate technology whenever appropriate. Both teachers are seeking technology assistance from the District Technology Facilitator, whose help includes finding relevant internet sites, installing software and working with children in the classroom on technology skills. In addition, the teachers are using each other and fellow TIP members for support and ideas. They are also seeking out of district staff development opportunities.

Project Objectives and Processes

As a result of the addition of six computers to the targeted first and first and second grade multiage classrooms and a year long staff development course in technology integration the students will increase their technology skills and problem solving ability during the months of September 1999 through January 2000. This will be measured by a student self assessment rubric, teacher anecdotal records, and student artifacts.

In order to accomplish the targeted objective the following processes are necessary.

1. Technology in the classroom will be increased by the addition of six computers, a 28 inch digital monitor, a video cassette player, and a remote control.
2. Teachers will model technology as a tool for learning, facilitate the students' acquisition of knowledge and integrate technology throughout the curriculum.
3. A student self assessment rubric developed from Technology Foundation Standards for Students will be designed and used.
4. Teachers will participate in the Technology Integration Program.

Project Action Plan

I. Technology in the classroom will be increased by the addition of three computers, a 28 inch digital monitor, a video cassette player (VCP), and a remote control.

A. The Board of Education has agreed to increase technology in the classrooms of teachers who have volunteered to participate in the Technology Integration Program (TIP). Computers will be in the classrooms for the start of the 1999-2000 school year. With the additional technology, teachers will be better able to implement what they have learned in the staff development program.

B. Teachers who requested a digital monitor, cart, and VCP will receive them.

II. Teachers will model technology as a tool for learning, facilitate the students' acquisition of knowledge, and integrate technology throughout the curriculum.

A. Using the existing district curriculum, teachers will incorporate technology on a daily basis. Means of integration may include but are not limited to the following:

1. Daily newsletter - Teacher interactively models word processing skills on the monitor as students share their daily experiences in the classroom. This sharing of events is then sent home on Fridays in the form of a classroom newsletter. After modeling how to use the digital camera, a

classroom photographer is selected each day to take photos and select one photo to accompany the news. As skills strengthen, students will be independently responsible for composing news on the computer. (The length of a news "article" will vary from one sentence to one paragraph depending on the students' abilities.)

2. Each student will create their own "journal" folder on the server and/or to a disk. Through modeling and peer coaching students will learn to save their work into their folders. Students will have weekly opportunities to add to their digital journal.
3. Every thematic unit will contain several technology components. Students may learn to create a slide show using Kid Pix Deluxe. Slide shows will first be done as a whole class and later done in cooperative groups. Students may also use CD-Roms, digital encyclopedias and other software applications to enhance their learning.
4. Students will be introduced to e-mail and will set up a class account. Weekly correspondence with partner classroom will take place. Correspondence may include riddles, interesting trivia, plans to meet to do activities together, or students may e-mail another teacher to ask permission to read to their class.
5. Students will be shown how to use the internet and given opportunities to use child centered search engines (such as www.yahooligans.com or www.askjeeves.com) to find information. This will first be modeled and then done in small groups with groups with adult supervision (as per district policy.)
6. Children will be given opportunities to strengthen their literacy skills by using Wiggle Works, an interactive reading program which allows students to read, respond, develop vocabulary skills, and use a letter board.
7. Students will learn how to create and interpret graphs using Graph Club. Students may graph daily weather conditions, temperature, classroom tooth loss, etc.

B. Staff development will be provided by technology coordinator, workshops,

and TIP meetings. TIP meets from 3:00 pm to 5:00 pm approximately twice a month for a total of 13 meetings. The Willow Bend experience workshop lasted two full days. One district wide teacher institute day is planned with a focus on technology.

III. A student self assessment rubric developed from Technology Foundation Standards for Students will be designed and used.

A. The students will assess themselves three times a year. The rubric will follow recommended technology benchmarks. Students will gain skills through their daily computer experiences. Benchmarks may include but are not limited to the following:

- use of painting and drawing tools
- use of e-mail
- compose, save and print using ClarisWorks
- turn computer on and off
- retrieve saved items from disk and server
- access internet and locate search engines
- download graphics from the internet
- use digital camera to take pictures and insert them into a document

IV. Teachers will participate in the Technology Integration Program.

A. Teachers of the targeted classroom will attend a year long technology integration class. The class meets thirteen times during the course of the 1999-2000 school year. Each class two hours long. Teachers will also attend an all day technology conference.

Methods of Assessment

In order to assess the effects of these interventions, students will complete a self-evaluation rubric at the beginning and end of the project. This will determine where growth has been made in using technology skills. Using anecdotal notes and student self assessments, teachers will assess the progress children have made in problem solving. Teachers will assess their comfort level with technology and teaching skills by completing a survey. Computers will be monitored in each classroom, usage will be noted in order to calculate the average use of computers at both the beginning and end of the project.

CHAPTER 4

PROJECT RESULTS

Historical Description of the Intervention

The objective of this project was to have students use technology as an effective tool for learning. This was accomplished through teacher training, assessment of teacher philosophy, direct technology instruction to the students and an awareness and effort on behalf of the teachers to integrate technology into every curricular area. The targeted classrooms were comprised of first and second grade students, in a single age first grade classroom and a multi-age first and second grade classroom.

The first intervention was teacher training. The teachers involved in the study were enrolled in The Technology Integration Program (TIP) sponsored by the targeted school district. Upon enrollment, the teachers were given 3 iMac computers, computer tables, and a $500 stipend. The class met on a bimonthly basis. Teachers were required to research software, websites and other technologies outside of the class. Each TIP class began with a sharing of information in grade level groups. Teachers also designed and implemented an engaged learning unit, incorporating technology throughout. Additional components of the class included mini lessons on using digital cameras, e-mail, web design, and conducting effective internet searches.

In addition to the TIP classes the district provided one technology related institute day. The morning consisted of a presentation. It focused on how technology will be used in the future, as well as how it will change the content and the way that teachers teach. The district technology coordinator gave a brief presentation on the progress and future plans of the district. The afternoon consisted of break out training sessions. Participants chose 2 sessions each lasting one hour. Options included web page design, internet searches, digital camera use, scanner use, or training on specified software. The targeted school has also had three sessions for web page training, each lasting one hour.

The philosophy of each participating teacher was carefully reviewed. Throughout the literature it was stated that teachers must be willing to give students choices in their learning, opportunities to teach one another and the chance to use technology on a daily basis. The teachers reflected and discussed their own philosophies. Within the TIP class, the teachers were exposed to many of their colleagues' philosophies. The targeted teachers developed a firm belief that technology should be integrated into the curriculum.

That philosophy was then implemented into the classrooms. Basic skills were introduced and directly taught at the start of the school year. These skills included, turning the computer on and off, saving to the "documents" folder on the desktop, using Kid Pix to make a picture and insert text, word processing using ClarisWorks, using bookmarks on the internet, and using the reading program WiggleWorks. Both teachers introduced the aforementioned skills within the first 2 months of the school year.

Once students were comfortable using these technologies, further technology skills could be added. The two targeted teachers differentiated in the order and type skills that were next introduced. The curriculums between teachers varied, as did the technological experience, therefore different skills were introduced in each classroom. By February of 2000 both classrooms had received instruction in selecting printers on the network and had established active classroom e-mail accounts. One classroom had students conduct independent internet searches using child friendly search engines, while the other class had conducted teacher led searches on the same search engines.

There were some skills that were only done in one of the classrooms. These included creating slide shows in the Kid Pix application, using the digital camera, downloading pictures off of the internet and saving to the district server.

Deviations from the original plan existed. The plan had called for individual desktop folders to be created for each student. Instead, students in both classrooms saved to a single folder created for the specific project. Weekly e-mail between classrooms did not occur, however students did e-mail teachers, principal, families, and experts in the community. Students were also never taught to save to a disk. This task was found to be obsolete. The iMacs are designed to be networked and do not have a floppy disk drive. To save work on an iMac, one must save to the harddrive or the district server.

To assess the effects of the intervention, the teacher-researchers used a student self assessment rubric, a teacher survey, and a classroom usage checklist. Each assessment was administered at the beginning and the end of the study. On the student rubric, students were asked to identify themselves as proficient, familiar or incapable of using technology in a variety of skill areas. Teachers were also asked on their survey to rate their comfort in both using and teaching technology. Additionally, they were asked questions about the frequency and purpose of their computer use. Finally, teachers were asked to identify factors that would help them to become technology proficient. The usage checklist was conducted to determine the frequency and kind of use of computers in the classrooms and computer lab.

Presentation and Analysis of Results

In order to assess whether students are using technology effectively, the student self assessment rubric, teacher survey and usage checklist were administered in September 1999 and February 2000. Students from non-targeted classes were also surveyed in February to determine and compare their technological skills. Finally, teacher anecdotal journals were reviewed.

Student Surveys

Because of student mobility, the rubric was given to 41 students in September and only 39 in February. After comparing the rubric results with their own anecdotal records both teachers found this survey to be much more accurate than the one given in September. The teachers believe this self assessment to be 95% accurate, as compared to their own records. The assessment results are listed in Table 10.

When comparing the results from September to February, it was found that the level of student proficiency had increased in all skill areas. Likewise, the percent of students who felt incapable of doing a task decreased in all areas except for using the digital camera. This indicates that the majority of the computer skills assessed showed significant increase during the course of this study. Using Kid Pix, ClarisWorks and WiggleWorks, researching online and turning the computers on and off were skills that over 50% of the students were proficient at. The teacher researchers felt that these skill areas were most regularly reinforced in their classrooms.

Table 10

Student Self Assessment Rubric - February 2000

Skill	% Proficient	% Familiar	% Incapable
I can draw a picture using Kid Pix.	74%	21%	5%
I can e-mail a friend or teacher.	33%	31%	36%
I can type a journal page, save it and print it using Claris.	74%	15%	11%
I can turn the computer on and shut it down.	82%	15%	3%
I can find things that I have saved on a disk or the server.	41%	31%	28%
I can find research on the internet.	51%	23%	26%
I can use WiggleWorks.	97%	3%	0%
I can download pictures from the internet.	28%	49%	23%
I can use the digital camera and put pictures in the news.	18%	28%	54%

Students rated themselves as proficient in an area if they were able to complete the given task on their own, without any assistance. Although all skills levels showed an increase, they were most dramatic in the areas of drawing in ClarisWorks or Kid Pix, word processing using Claris, researching and downloading pictures from the internet and using Wiggle Works. Using the digital camera showed the least amount (less than 10%) of growth. Because manipulating the digital camera requires more refined motor skills, the teacher researchers felt it was not developmentally appropriate to introduce this skill at the start of the year. It is anticipated that by the end of the year, this area will see greater growth. Figure 1 compares the student self evaluated proficiency levels for targeted skill areas in September and February.

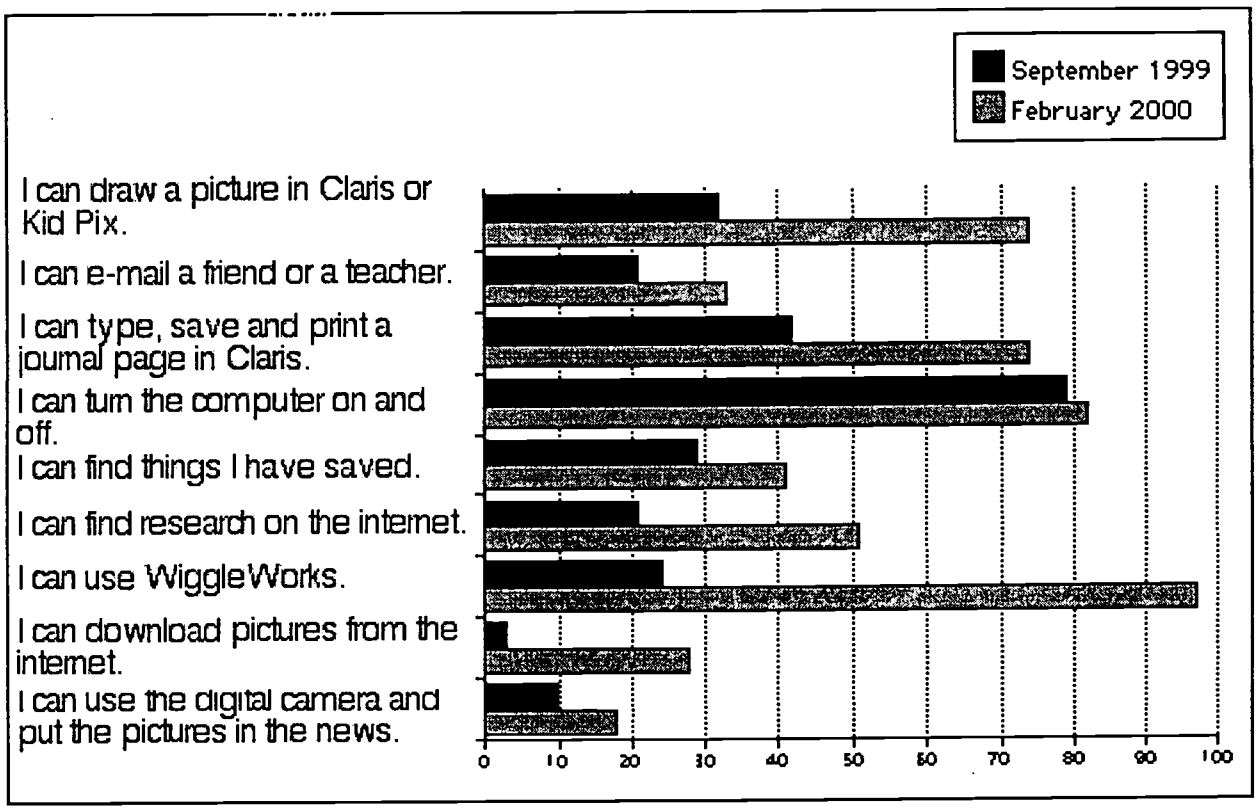

Figure 1. Comparison of student proficiency levels

After charting the growth made in the targeted classrooms, the teacher researchers felt it necessary to determine whether the growth made was due to their interventions. Questions arose about whether growth would naturally take place due to age and out of school experiences. Therefore, two additional classrooms of children were surveyed using the same student self assessment rubric. The selected classrooms matched the characteristics of the targeted classrooms. One was a single age first grade room and the second was a first and second grade multi-age classroom. Neither of the additional teachers had participated in the TIP program, nor had they received any additional training or computers. In total 33 students were asked to evaluate their own skills. The results are listed in Table 11.

Table 11

Student Self Assessment of Non Targeted Classrooms

Skill	% Proficient	% Familiar	% Incapable
I can draw a picture using Kid Pix.	31%	56%	13%
I can e-mail a friend or teacher.	18%	18%	64%
I can type a journal page, save it and print it using Claris.	61%	6%	33%
I can turn the computer on and shut it down.	70%	21%	9%
I can find things that I have saved on a disk or the server.	24%	36%	40%
I can find research on the internet.	33%	27%	40%
I can use WiggleWorks.	39%	9%	52%
I can download pictures from the internet.	3%	18%	79%
I can use the digital camera and put pictures in the news.	9%	27%	64%

When comparing the targeted and non-targeted students, it was found that students receiving the technology intervention had higher self evaluated skills than those who had received no intervention. The results of the comparison are found in Figure 2.

The September and November student self evaluations show substantive growth in the assessed areas. When compared to other students at the school, the targeted students also showed a significantly higher confidence in their technology development. Teachers also showed growth in their skills and willingness to integrate technology into their curriculums. Since first surveyed, all teachers had received more training and had several more months to increase their technology awareness.

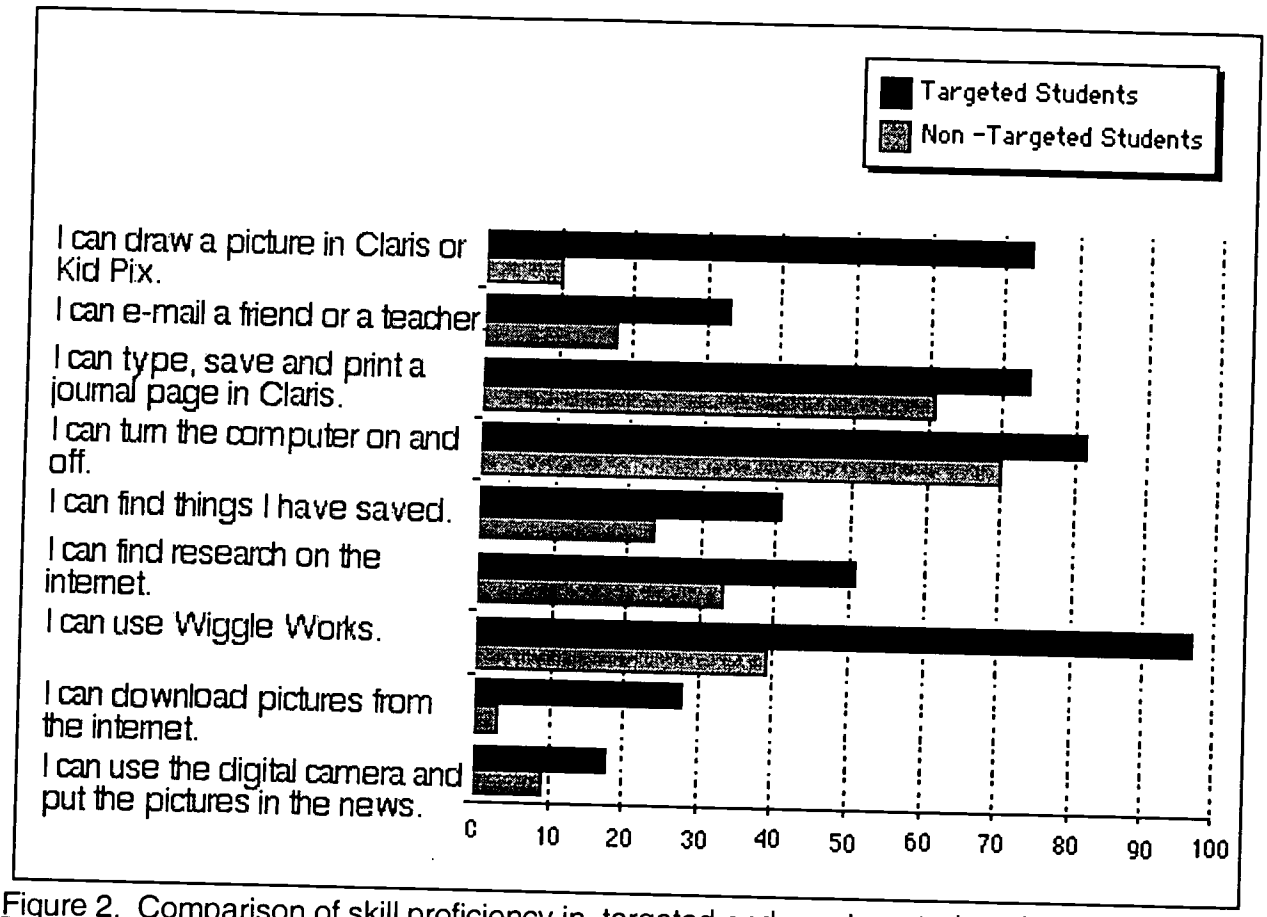

Figure 2. Comparison of skill proficiency in targeted and non-targeted students

Teacher Surveys

Teacher surveys were again given in February of 2000. The surveys asked teachers to rate their comfort levels using and teaching technology. Specific questions on how technology is used were also asked. As with the previous survey, 13 out of the 14 surveys given were returned. During the months since the first survey was given, 5 of the 14 classroom teachers had been participating in the TIP project and had received the additional 3 iMacs for their classroom. All teachers had participated in one technology based institute day and all were given training opportunities in web page design. Table 12 reports the results of the teacher comfort levels in using technology resulting from the February 2000 teacher survey.

Table 12

Teacher Comfort Levels Using Technology - February 2000

Technology	Years Available	%Comfortable	% Uncomfortable
Using CD ROMs	6	85%	15%
Saving to a disk	6	100%	0%
Using Claris Works	6	92%	8%
Using Kid Pix	6	69%	31%
Using WiggleWorks	4	54%	46%
Using digital cameras	4	46%	54%
Using scanners	4	15%	85%
Using the internet	2	62%	38%
Using e-mail	2	85%	15%
Saving to a server	2	46%	54%
Creating web pages	2	15%	85%

The results of the survey show that no comfort levels have decreased. Teachers have become slightly more comfortable in saving to a disk, using ClarisWorks, using Kid Pix, using digital cameras, using the internet, and using e-mail. Comfort levels have remained constant in using CD ROMs, scanners, and WiggleWorks, saving to a server and creating web pages. Teachers listed that more time, support, training and equipment were important factors in increasing their comfort with technology.

With teachers showing some increased comfort in using technology, the survey next asked about their comfort in teaching technology. The comfort level in teaching some skill areas dropped since September. The February results are reported in Table 13.

The greatest change in the results from September to February is the number of teachers who no longer find that the skill is not applicable to their students. Comfort levels in teaching the following skills increased: using WiggleWorks, digital cameras, scanners, the internet, e-mail, and creating web pages. Using CD ROMs, ClarisWorks, and saving to a

server remained constant. However, the comfort levels in teaching Kid Pix and saving to a disk decreased.

Table 13

Teacher Comfort Levels In Teaching Technology

Technology	Years Available	% Comfortable	% Uncomfortable	% Not Applicable
Using CD ROMs	6	77%	23%	0%
Saving to a disk	6	62%	30%	8%
Using Claris Works	6	77%	23%	0%
Using Kid Pix	6	46%	46%	8%
Using WiggleWorks	4	54%	38%	8%
Using digital cameras	4	38%	54%	8%
Using scanners	4	15%	77%	8%
Using the internet	2	62%	38%	0%
Using e-mail	2	54%	38%	8%
Saving to a server	2	23%	69%	8%
Creating web pages	2	15%	85%	0%

The final section of the teacher survey was used to determine the frequency and purpose of technology use. The greatest increase was found in the frequency of technology integration into the curriculum. The results of this section of the teacher survey are listed in Table 14.

When comparing the results in Table 14 to those completed in September (Table 5), it is observed that free time, a non curricular use of technology, remains the most frequent way of using computers in the classroom. However, all teachers reported integrating technology into the curriculum at minimum, on a monthly basis. While in September, 15% of teachers surveyed were only integrating technology once a trimester. Using word processing programs for student writing and publishing continues to be done on an infrequent basis. The computer usage checklist will determine how frequently technology is being used within the building.

Table 14

Frequency of Technology Use

	Never	Once a trimester	Monthly	Weekly	Daily
Frequency of Curricular Technology Integration	0%	0%	23%	69%	8%
Frequency of Free Time Use	0%	0%	0%	46%	54%
Frequency of Student Word Processing for Journal writing	31%	8%	15%	23%	23%
Frequency of Student Word Processing for Publishing	38%	15%	23%	23%	0%

Usage Checklist

To see if the available technologies were being used more frequently, the technology usage checklist was again implemented in February 2000. The building technology facilitator was asked to complete 10 more random checks to see how many computers were on and being used by students and teachers. The checks were done at random times during the day over the course of one week. A comparison of September and February usage is listed in Table 15.

Table 15

Classroom Technology Usage - September vs. February

% Turned Off		% Used by Students		%Used by Teachers		% On but Not Used	
Sep.	Feb.	Sep.	Feb.	Sep.	Feb.	Sep.	Feb.
31%	8%	14%	25%	12%	14%	43%	53%

Table 15 indicates that there has been an increase in both student and teacher use of the computers. The most noticeable increase is found in the amount of computers turned off. In February almost one third of the classroom computers were not even being turned

on. With more computers being turned on, it is not surprising to see that both student use and teacher use of the computer has increased.

The usage of the computer lab was once again monitored. During the selected week four classroom teachers used the computer lab. Special area teachers, such as English as a Second Language and Early Childhood, also used the lab. The numbers of children using the lab has increased since September. Although the lab is being used more frequently, it is still not being used to its full capacity and often sits vacant. The teacher survey, revealed that many teachers felt that the computers were "out of date." Their comments suggested that if the equipment was more "up to date" they would use the lab more frequently. When reviewing their journals, the teacher researchers have found that their own classroom "mini labs" were highly effective in fostering peer interactions with technology.

Teacher Anecdotal Journals

The teacher journals revealed that as students acquired skills, they readily took on the role of peer mentors. The students were eager and willing to help each other as technological problems arose. Teachers did facilitate this interaction initially by encouraging students to ask peers for help before coming to the teacher. As time passed, students seamlessly took on the role of problem solver. During class lessons, children would often shout out suggestions to solve problems as they saw them arise. Students were even able to aid other teachers who encountered technological problems. The biggest challenge now for the teacher researchers was to show students how to teach others, without solving the problems for them. The teachers developed "the hands off policy." When helping others, students must use their words rather than their hands. This will allow the child receiving help to take ownership of the task.

Students are also realizing the role technology can play in their education. The internet has become a logical source of information. Just as children would go to the library for a book, they use the internet to find answers to their questions. The children in the targeted classrooms now go online independently. E-mail has become a resource for communicating with experts. Students view e-mail as being as easily accessed as the telephone or mail. To demonstrate what they have learned, students are choosing multimedia tools. Posters now include graphics down loaded from the internet, interesting fonts, and have been checked for correct spelling. Children also appreciate that eraser

marks cannot be found on word processed documents. Slide shows, video clips and digital photos are all found in student projects.

The teachers as well as the students have experienced the thrill of technology. During this process an unanticipated aspect of teacher training became readily apparent. A mentor relationship was developed between the two participating teachers. One teacher was skilled in the use of technology. That teacher was able to guide, train and facilitate in the learning of the second teacher. The second teacher brought many fresh ideas to the partnership and was often responsible for the creative side of projects. Both teachers felt that their use of technology was improved and expanded because of this partnership. The staff of the targeted school began to see both teachers as technology experts and would turn to both when problems arose. Further conclusions and recommendations will be discussed.

Conclusions and Recommendations

This research showed that when integrated into the curriculum on a regular basis, technology becomes a powerful tool for learning. In order for this to occur teachers must receive ongoing training, be committed to using the technology and have the equipment necessary within the walls of the classroom. The children naturally posses the curiosity and desire to use technology.

The most effective form of teacher training found was mentoring. The key to mentoring is time and trust. Both teachers felt comfortable asking questions of each other, no matter how simplistic they may seem. Both were also committed to the goal of increasing the effective use of technology in their curriculums and investing the time needed to help one another. As their skill levels increased, the teachers found more and more ways to integrate technology into the curriculum. Their open-minded approach allowed them to absorb what researchers suggested about giving students more choices, freedom to explore, and time to problem solve independently. They very quickly found themselves facilitating the learning of their students. Technology talk filled their conversations. Both were excited about what their students were doing, their independence, and their enthusiasm. Together, the teachers brainstormed ways to exercise their teaching philosophy and worked together to solve technology problems as they occurred.

In the past, the teacher researchers had participated in various workshops and in-services both in and out of district. They hoped to increase their technological skills. The teachers usually left with a few new concepts or ideas. Although the information received at these workshops was useful, it did not always meet their immediate needs. Mentoring, on the other hand, allows teachers to receive immediate feedback on the issues that are most important and relevant to them. When answers are not immediate, good ideas are often left uncompleted or discarded.

The mentor relationship allowed a greater variety of technology enhanced projects to occur, as the mentors often fed off of each other's ideas. Both teachers had committed themselves to teaching technology skills within the curriculum. Technology was never viewed as a separate entity. When planning their curriculum, a technological component was always included. Skills were taught as they became necessary to complete tasks within curricular areas. This integration allowed students to see technology as a tool.

Many teachers at the targeted building indicated on the teacher survey a desire for a separate technology curriculum. This curriculum would be taught by a "technology teacher", just as music is taught by the music teacher, in a separate classroom. When technology is taught separately, it's application in the classroom is not readily apparent. Students may develop technology skills, but there is no authentic application of those skills. Therefore, it is recommended that technology is taught within the classroom, in every area of the curriculum. In order for technology to be taught within the walls of the classroom, there must be adequate equipment available.

Along with the original PowerMac computer, the 3 additional iMacs allowed more students to access technology on a regular basis. With the aid of the 27" monitor, group lessons could be taught and implemented within the classroom. The monitor gives all students a visual reference when directions are being given. The monitor also gives students the opportunity to share their work with the class. With several computers in the classroom, students are able to complete tasks on a rotating basis. Also several tasks can occur during the course of the day. For example, during the length of an average day some students may create a math story problem using Kid Pix, research their desert animal on-line, watch a Living Books CD ROM, and type a journal page. In a week's time, most students will have completed all of the above tasks. In a lab situation, students in the

targeted building would have only one hour a week to work on the computer. Accomplishing all of these tasks in a week would be impossible. Examples of student work done on the computer can be found in Appendix D.

Technology enables students to become problem solvers. As teachable moments arise, students and teachers have the internet, CD ROMs, virtual tours, etc. at their disposal. Having technology available in the classroom allows students to find solutions to their questions as they occur. There is immediate access to information. A weekly lab time does not support student problem solving. When computers are not in the classroom, technology cannot be used as an effective tool for learning.

Recommendations to others include: teacher mentoring, complete integration of technology within the curriculum, and the availability of technology in the classroom. The TIP program provided the much needed equipment. This allowed for daily integration to occur. Although the TIP program provided the opportunity for growth, it was not as effective as mentoring. Because the TIP program only met once a month, it did not provide immediate feedback to teacher questions and problems, which a mentor was able to provide.

In conclusion, technology is an appropriate and effective tool for learning with primary students. Technology is intrinsically motivating to students. It has been demonstrated that regular use of technology strengthens students' problem solving and communication skills. For this reason, training teachers on how to use technology effectively is essential School districts must provide staff development opportunities. Additionally, it is necessary for teachers to view technology as an essential tool in their classroom. Books, paper and pencil, are the basic tools of all subject areas. The computer can and should be used as such a tool. Therefore, classrooms must be provided with enough equipment to allow all students regular access. When all of these components are implemented students will develop highly successful technology skills.

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APPENDIX A

TEACHER SURVEY

Teachers,

We are doing research for our masters program and would like your help in gathering information about technology use at Ross. Just so you know, the results of this are for our own private use and is no way linked to any school related issues. We appreciate your honesty and thoroughness. Please return to Laurie or Julie by September 10, 1999. Thank You!
Julie Murray and Laurie McDermott

Using 1 as very uncomfortable and 5 as very comfortable,

I. Rate **your** comfort level on the following:

• creating web pages	1	2	3	4	5
• using e-mail	1	2	3	4	5
• using the internet	1	2	3	4	5
• using CD ROMs	1	2	3	4	5
• saving to a disk	1	2	3	4	5
• saving to the server	1	2	3	4	5
• using Claris	1	2	3	4	5
• using Kid Pix	1	2	3	4	5
• using Wiggle Works	1	2	3	4	5
• using digital cameras	1	2	3	4	5
• using the scanner	1	2	3	4	5

II. Using the same scale please rate your comfort level when **teaching your students to use** the following:

• creating web pages	1	2	3	4	5	n/a
• using e-mail	1	2	3	4	5	n/a
• using the internet	1	2	3	4	5	n/a
• using CD ROMs	1	2	3	4	5	n/a
• saving to a disk	1	2	3	4	5	n/a
• saving to the server	1	2	3	4	5	n/a
• using Claris	1	2	3	4	5	n/a

• using Kid Pix	1	2	3	4	5	n/a
• using Wiggle Works	1	2	3	4	5	n/a
• using digital cameras	1	2	3	4	5	n/a
• using the scanner	1	2	3	4	5	n/a

III. Please circle the one that best applies.

How frequently do you integrate technology into your curriculum? (Ex. Technology is part of a thematic unit or project.)

never *once a trimester* *once a month* *weekly* *daily*

How frequently do you use technology as free time? (Ex. when work is finished)

never *once a trimester* *once a month* *weekly* *daily*

How frequently do you use technology for journal writing? (Ex. students are creating on the computer.)

never *once a trimester* *once a month* *weekly* *daily*

How frequently do you use technology for editing? (Ex. Students type a good copy of handwritten work?)

never *once a trimester* *once a month* *weekly* *daily*

Where do your students use computers more?

Lab *classroom* *equally in both*

IV. Check all that apply.

What factors would increase your comfort levels in using technology?

- ☐ in district staff development
- ☐ out of district staff development
- ☐ more technology support
- ☐ more equipment
- ☐ a formal technology curriculum
- ☐ other_____

APPENDIX B

STUDENT SELF EVALUATION SURVEY

1. I can draw a picture in Claris and Kid Pix.	
2. I can e-mail a friend or teacher.	
3. I can type a journal page, save it, and print it using Claris.	
4. I can turn the computer on and shut it down.	
5. I can find things that I saved on a disk or on the server.	
6. I can find research on the internet.	
7. I can use Wiggle Works.	
8. I can download pictures from the internet.	
9. I can use the digital camera and put the pictures in the news.	

APPENDIX C

ENGAGED LEARNING FRAMEWORK

FOR NATIVE AMERICAN UNIT

An Engaged Learning Study of Native Americans
Unit Framework

*Social Studies/Multidisciplinary
*First and Second Grade

Learner Description
Students are heterogeneously grouped, regular education first and second graders from a suburban middle-class community. Some students are not English proficient; others may receive Title 1 reading and/or other assistance.

Overview
Children from the first grade and first and second grade multiage class were involved in a study of Native Americans. Classes were divided into small groups. Each group researched a specific region of Native Americans. The classes brainstormed what elements were important to a culture. Children were then encouraged to discover the food, housing, art, transportation, clothing, music, dance, and beliefs of their region's Native Americans.

Rationale
The goal of this unit was to showcase the similarities and differences between Native Americans from different regions of the United States. It was important to end the stereotypes that children have of all Native Americans.

This unit qualifies as an engaged learning unit because the students are responsible for choosing their region of study, collaboratively obtaining information, recreating the culture in the classroom and sharing their information with other classmates.

Students were given many opportunities to study their region by using the internet, videos, e-mail, and other available technological resources.

This project is authentic, meaningful, and challenging for students because students "became the Native Americans" They knew they had to have food, tools, and shelter to stay alive. Once they had the basic elements to maintain life they could learn more about their culture. Each class had a culminating activity that students were preparing for. The first grade students created a Native American museum in their classroom to share their findings. Students from other classrooms came to learn from their findings. The children in the multiage classroom were preparing for a Powwow, where they too would celebrate and share their newly discovered culture. The challenge comes from the open-ended nature of the project as well as from the expectation that the students will be required to teach what they've learned. The students could take it as far as they wanted to.

Goals - Content, Cognitive and Social
Students will:
*become more aware of the diversity and commonalities of Native American cultures.
*begin to develop research skills using available resources.
*begin to develop presentation skills.
*begin to develop skills needed to collaborate within a group setting.

Learning Activities
1. Teachers introduced Native American life by reading both fictional and nonfiction books to students.
2. Students gave themselves Native American names.

3. Students collectively decided on a region that their group would study.
4. Students created a list of cultural elements to refer to as well as a rubric to assess the acquired information and presentation skills.
5. With teachers as facilitators, regional groups developed ongoing goals about what they needed to accomplish/learn.
6. In their groups, students found information about their topic using a variety of resources.
7. Students created tools, food, housing, dances, musical instruments, baskets, fishing baskets, canoes, dog sleds, to demonstrate their chosen culture.
8. Cultures were shared either in a classroom museum or a classroom Pow Wow.

Assessment
Students were assessed on an ongoing basis. The accuracy and the amount of information was regularly reviewed. The teachers, acting as facilitators, conferenced with groups to assure that all members were actively participating and that the groups continued to make progress. Students were encouraged to refer back to the class made list of cultural elements and be sure that all elements were represented in their research. Student presentations and written reflections served as an excellent assessment tool.

Management
Groups were managed through teacher conferences. Teachers acted as facilitator to make sure that each individual is engaged. Each group was given a plastic tub to hold their research materials and artifacts. As students created more artifacts, tables and shelves had to be cleared to store their things. Students had access to all classroom and library materials. The school library is set up for flexible access with help. Parents also helped in the room with internet searches, and reading the found research.

APPENDIX D

STUDENT WORK SAMPLES

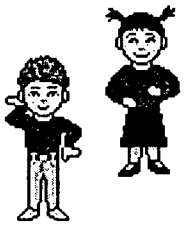
Work samples include:

- A reading response using the WiggleWorks application
- Math stories using the University of Chicago Math Program format- created on Kid Pix
- Classroom newsletter created in ClarisWorks- text and digital photos by students
- Calendar to mark monthly classroom events- created using Super Print
- Big Cheese - student peer interviews created on ClarisWorks
- Tongue Twisters - created on Kid Pix
- Crocodile Research - students searched on-line for answers to questions using www.google.com
- Student journal entry- created in ClarisWorks
- Learning Reflection- created in ClarisWorks
- Graphic number sentences- stamped in Kid Pix
- Desert research - research found on-line, pictures downloaded, final project created in ClarisWorks
- Digital Photo Album
- Do You Believe in Leprechauns? Graph - created in Graph Club

Its about a dad and mom and a girl.
They are makeing a house for a dog.
They use wood.They make a roof.They
paint the roof red.They sweep the dust.They
put on sand paper.

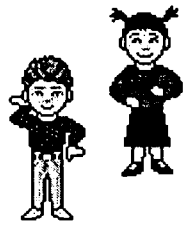

UNIT
POMPOM
Dana had2 pompom and I had2pompom
How many all together?
2+2=4

Classrom Newsletter in ClarisWorks



The Investigative Reporter

March 17, 2000



Monday

Today we had lots of e-mail. We got e-mail from Mrs. Warner, Mrs. Fixler, Mike's mom and Mike's aunt. We read the e-mail after calendar. We like to read e-mail.
By Kelsey

Photo by Nobue

Today we did author studies. In author studies we made posters. It is about one book that the author wrote. We did it in the room.
By Atara

I do math. We got a new math book in math. We did a paper that was of pluses.
By Janett

Tuesday

Today we wrote about our author study. Some of the groups had to stay inside and they had to finish. Mrs. Murray went around the room to see our work.
By Nicole

Photo by Eric

In Dear time Friday tutors tutored today because on Friday we don't have school. Right after Dear time we went to music. In Dear time we had about 25 minutes to read. In Dear time we didn't have partner time. We started Dear time about 12:40 and we stopped at 1:15.
By Mike

April 2000

Sun	Mon	Tues	Wed	Thurs	Fri	Sat
						1
2	3	4	5	6	7	8
9	10	11 Makeing earth day poster	12 Tori's birthday	13	14	15
16	17 literature fair Edger's birthday	18	19	20	21 good friday no school	22
23/30	24 cogat	25 cogat	26 cogat	27 techer institute day	28 walk to the PUBLIClibary	29

Calendar Created in SuperPrint

Big Cheese

Student Peer Interviews in ClarisWorks

Karoline

Pink is Karoline's favorite color.

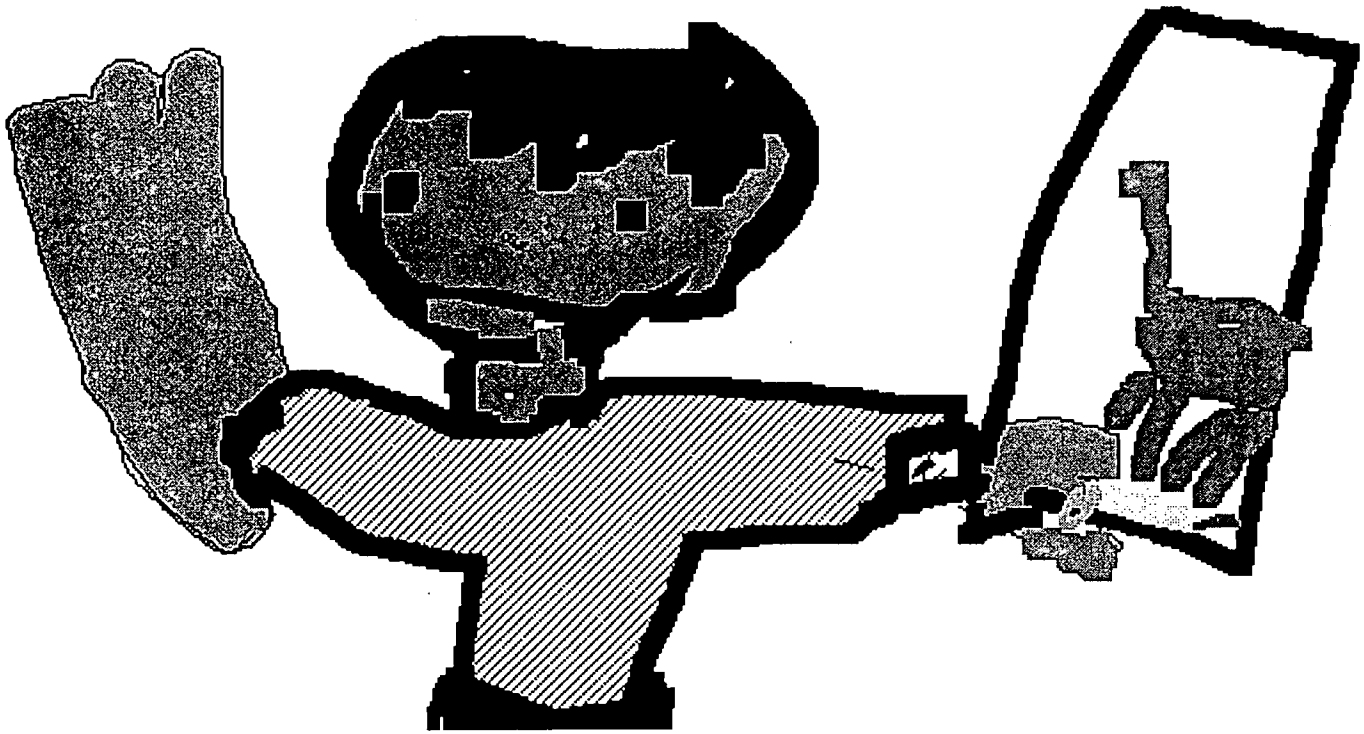
Blue is Karoline's second favorite color.

Karoline has no pets. Karoline likes turtles.

Karoline's nickname is String.

Spaghetti is Karoline's favorite food.

Dan drew dynomite dinosaurs.



Crocodile Research

Answers found online

Names _____

Crocodile Research Project

1. Do a search on google.com for crocodiles.

2. Pick a website and answer these questions.

Can crocodiles see well?_____

_____

How do crocodiles use their teeth?_____

_____

_____

What is crocodile skin like? _____

_____

_____

Write a research question.

_____

_____

_____

The answer to my question is...

_____

_____

Me and my friends went bike riding together. Ater we had a picknick and my dad read to us. Then we rided agen with my friends. The End
By Dana

My
Brothers
Accident

I was timing my brother around the block and he fell on the corner.He brokethe biggest bone.It is the femur bone.He fell off his bike. The End

By Matt

All about owls.

I learned owls cough up owl pelist. I learned that in owl pelist there are bones and fur. I learned some big owls eat little owls. With out owls the rodents would eat the food from the farms. I like learning about owls.

The Netherlands

Oct/12/99

In the Netherlands I learned that they have different money. I also learned that thier houses are surrounded by water. I learned that they yous dams so the water doesn't flood the vilig. Mrs.Murray read a book.It was called the hole in the dam.

BY VANESSA

Desert Research

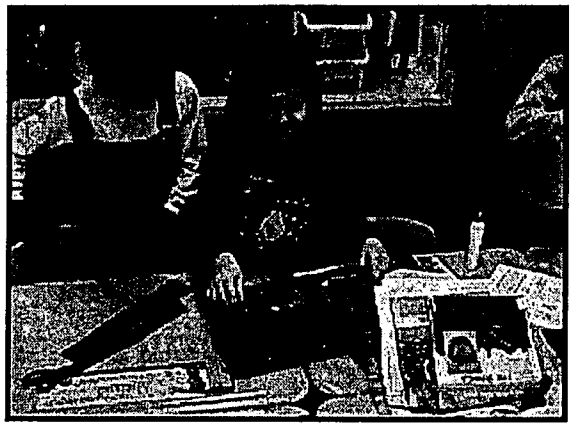
Tarantulas live in a tunnel under ground. Some females may live long as 25 years. Tarantulas eat grass hoppers and they eat beatles and they eat bugs. They are friendy but some bite.

by

Steven

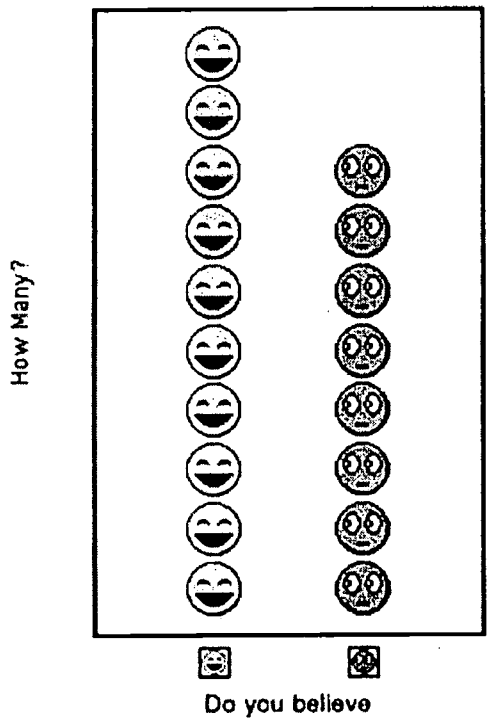
Digital Photo Album

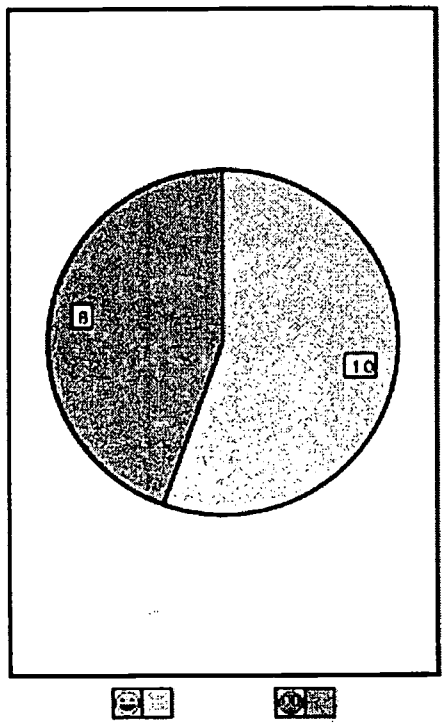
Native American Research



Do You Believe In Leprechauns?
Created in Graph Club

Do you Believe in Leprechau...	
What?	How Many?
	10
	8





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